

1RXS J184542.4+483134: a New Cataclysmic Variable with Short-Period Photometric Variations

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Star Name:	USNO-B1.0 1385-0291789, GALEX J184542.6+483130, 1RXS J184542.4+483134		
Coordinates (J2000):	18 45 42.62, +48 31 30.8		
Variability type:	UGWZ.;	Limits, System:	17.8-19.6;
Period:	0.05491 d;	Epoch(max):	JD 2455488.3279

Remarks:

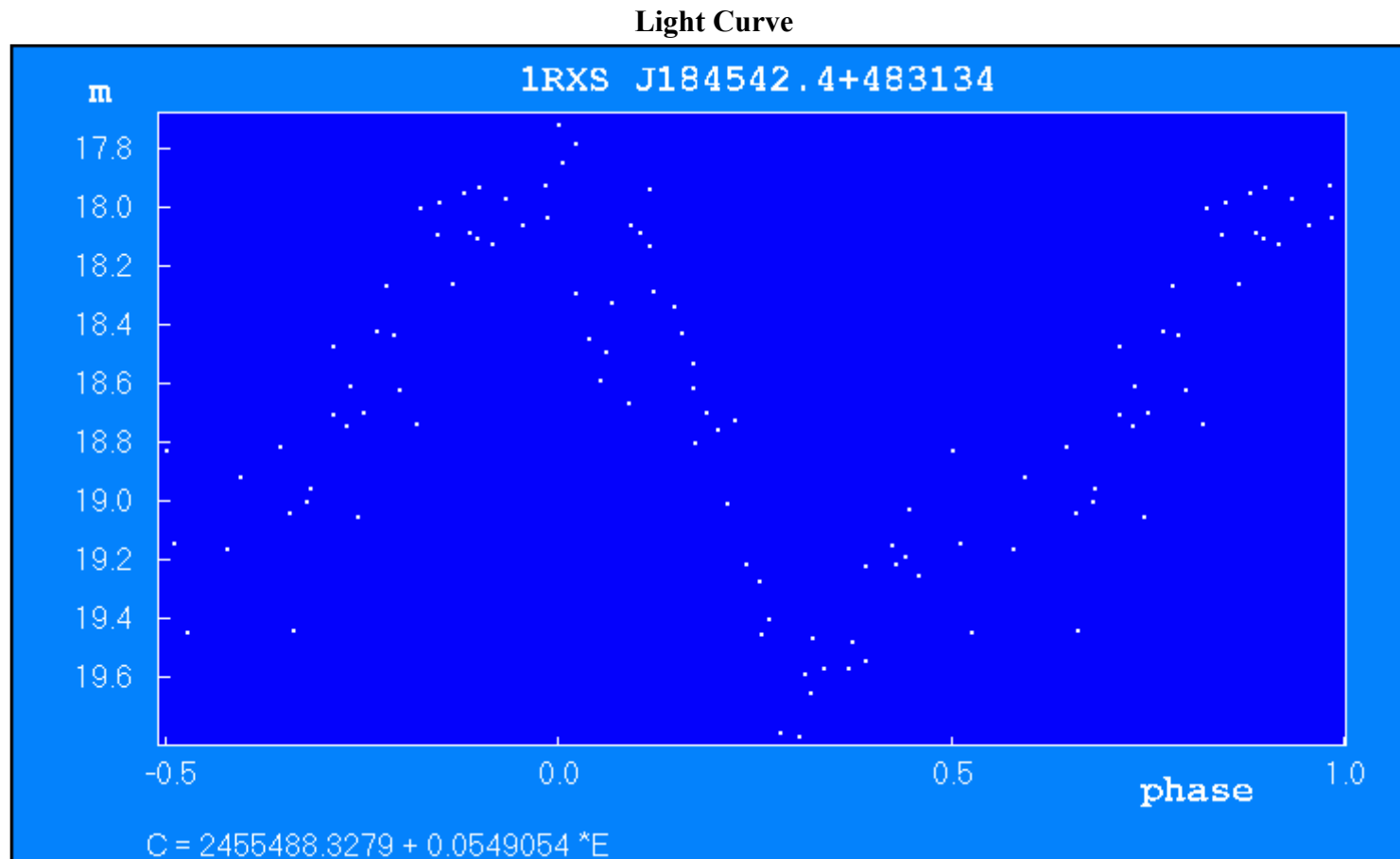
The long-term optical variability of 1RXS J184542.4+483134 (RX J1845.7+4831) was found by Denisenko and Sokolovsky (2010) who used their method of data analysis in 1RXS and USNO-B1.0 catalogs. The X-ray source, previously without an optical identification, could be identified with USNO-B1.0 1385-0291789 inside the ROSAT error box. The object's B1.0 magnitudes for two epochs differ by almost 5 magnitudes ($B1 = 21.32$, $B2 = 16.61$). Based on the X-ray hardness ratios, archival light curve from the Palomar Digitized Sky Survey plates, and no information on a detected proper motion, the object was assumed by Denisenko and Sokolovsky to be a quasar. Other indirect arguments in favor of QSO classification were the presence of a galaxy within 1'E and 1'S of the variable object and a cluster of galaxies at about 2'W and 1'N. The object is located at galactic latitude $b = 21^\circ$. Following the announcement of the large-amplitude variations at an astronomy forum, one of the authors (E.S.) started CCD monitoring at a private observatory. On September 25–November 5, 2010, a total of 73 unfiltered images with 200-second exposure times were taken. A Sky Watcher 12" Newtonian telescope and a SBIG402ME CCD camera (Kodak KAF0402 chip, Peltier cooled) were used. The reductions of CCD frames and photometry analysis were carried out with the CCDSoft, MuniWin packages and WinEffect software by V. P. Goranskij. USNO-B1.0 1385-0291764 ($R = 15.5$) was used as a comparison star and USNO-B1.0 1385-0291771, as a check star. Our observations show a high-amplitude, short-term variability of the object that rules out the QSO classification. The photometric period, probably reflecting the orbital period, was found to be 0.05491(1) d, or 79.07(1) min. Such a short value is typical of dwarf novae of UGSU or UGWZ types. The light curve shape is well described by a quasi-sinusoidal wave typical of a reflection effect caused by irradiation of the red dwarf by a hot compact primary object, with two 0.2-mag humps shifted in orbital phase by about 0.2 and 0.7 with respect to minimum light, and a narrow eclipse-like dip by 0.8m at about 0.1 P after the maximum. This dip can be explained by a self-eclipse of the accretion stream or by an eclipse of the hot spot on the surface of the white dwarf. The most remarkable feature of RX J1845.7+4831 is the full amplitude of sinusoidal wave of 1.8m, not observed in cataclysmic variables before. For instance, Woudt and Warner (2003), discussing the light curve of RX J1039.7-0507 (YY Sex) with an orbital period of 0.0656 days, claim that the star's 1.1-mag sinusoidal modulation requires a very hot

primary, probably having undergone a nova eruption in the past 10–20 years. This hypothesis can be also applied to RX J1845.7+4831 to explain why the 1990 Blue Palomar plates show it brighter by at least 1m (at 16.6m) than its current brightness at maximum and even by 2m brighter than the 79-minute averaged brightness. The long maximum (more than 25 days in duration), covering the 1990 June 26 and July 21 plates and originally interpreted as a QSO outburst, could have been a fading phase with rebrightenings after an UGWZ or classical-nova outburst. This is also supported by the fact that the variable has not yet returned to its pre-outburst quiescent level of 21m which is recorded by the Palomar plate of the first epoch. It should be noted, however, that even the classical Nova Cygni 1975 (V1500 Cyg) had a modulation range of only 1.2m 12 years after the eruption, reducing to 0.7m by 1995 (T+20 years). Thus, the 1.8-mag modulation in RX J1845.7+4831 about 20 years after its possible outburst in 1990 is unprecedented for cataclysmic variables. A reflection effect that large (or even larger) is observed for low-mass X-ray binaries. This might mean that RX J1845.7+4831 is an X-ray binary with a neutron-star primary. A definite final judgment on the nature of this object requires time-resolved spectroscopy. We also encourage follow-up photometric observations in order to monitor for a future possible outburst of this system.

References:

Denisenko, D.V., Sokolovsky, K.V., 2010, arXiv:1007.1798v1

Woudt, P.A., Warner, B., 2003, Monthly Notices of the Royal Astron. Soc., 339, 731



The light curve of J184542+483134 with $P = 0.05491d$.

Finding Chart



The finding chart for the variable star J184542+483134. 10'x 10'.

Data Source

1. [j1845+4831.txt](#)